EMODnet Thematic Lot n° 3

EMODnet Phase 2 – Annual (interim) report

Reporting Period: Sept. 2013 to Aug. 2014

Date: 09/09/2014

1. Highlights in this reporting period

Provide a summary of the key achievements and/or events of interest to a wider audience within this reporting period you wish to highlight – this can be based on the indicators or any other of the reporting sections. [Provide a bullet list]

- Integration of the modelled map produced for Biscay and Iberian Peninsula by the Interreg MeshAtlantic project and the habitat maps from survey collated by the MeshAtlantic and MESH projects into the EMODnet Seabed Habitats mapping portal
- Creation of a new EMODnet Seabed Habitats website
- Production of a preliminary modelled map for the Adriatic sea
- Production of a preliminary modelled map for the Canary Island
- Definition of preliminary list of habitats to be modelled in the Black Sea
- Contacts established with, and cartographic seagrass meadow data received from adjacent Adriatic countries

2. Summary of the work done

Provide a summary of the work done and an overview of the main tasks which remain to be done.

Work done

- Definition of primary environmental factors to be used in modelling (and back-up proxy if needed) of the lower limit of each biological zone per sub-region
- Definition per sub-region of a list of habitat types to be modelled based on intersection of information concerning specific environmental parameters
- Definition of a preliminary mask, for the area influenced by high Po riverine input, for the Adriatic sea model
- Digitization of IBCM map for the East Mediterranean & Black Sea
- Delivery of synthetic seabed substrate maps for the Adriatic Sea and Canary Islands
- Collation of hard substrate data in the Italian portion of the Adriatic Sea and of *Posidonia oceanica* and Cymodocea meadows data in the Adriatic
- Definition of the bathyal – abyssal boundary in the Adriatic Sea
- Models runs for the Adriatic and Canary Islands

Tasks that remain to be done

- For the second year missing substrate data gaps will be considered and data from other sources included (e.g. rocky areas as initial MSFD descriptor 1 plus other seabed habitat maps such as those from the Italian Magic project).
- Regarding shallow water rocky substrate, HCMR is developing a methodology to use any available swath bathymetry map and bathymetric data from navigational charts published by national authorities for steep near-shore areas and extrapolate rocky basement outcrops as derived from onshore geological mapping data.
- In Adriatic there is a need to integrate the Posidonia and Cymodocea meadows, acquired lately from the Croatian national focal point, in the substrate layer and scope for potential other maps, in order to improve the final modelled map.
- For whole Mediterranean define meadows in best conservation status and acquire point data on their lower limit and respective bathymetry to be used in validating light thresholds for the infralittoral lower limit.
- For the Black Sea confirm depth zone definition and thresholds and list of habitats.

- For all regions, the method of confidence assessment and most appropriate statistical techniques for classifying environmental variables need to be determined and implemented.
- Intensify collation of habitat samples and implement collation of survey maps.

3. Challenges encountered during the reporting period

Provide an overview (preferably in table format) listing and short explanation of the main challenges encountered during the reporting period and the measures taken to address them.

WP	Challenges encountered
WP1 & WP4	Unavailability of access to geodatabases of habitat types stemming from other EU funded projects (e.g. Mediseh). This mapping data would have allowed the creation of a more homogeneous and complete additional substrate layer concerning seagrass beds. Seagrass maps or point data together with that of other benthic habitats are crucial for defining environmental parameter thresholds such as light and energy necessary for the modelling of specific habitat types and biological zone delimitation.
WP1	In the Black Sea (i) absence of concerted regional scientific documents attesting biological zone and benthic bionomy, which slowed down the final definition of the habitats that can be modelled through the EUSeaMap modelling approach, (ii) availability of current, wave and light data still an issue. This makes the harmonisation of habitats and biological zones between countries a questionable matter.
WP1 & WP2	Absence of bathymetry, sediment and biological sample station information/biocenosis for the Eastern Adriatic sea has hindered advancement of biological zone delimitation and eventual mask delimitation in areas influenced by rivers, as well as preparation of data layers necessary for modeling in the Croatian inter-island inlets and archipelagos and along the Albanian coast.
WP3	Obtaining biological sampling data for all Black Sea region has been difficult, given the number of third-party countries.
WP3	Contacts initially taken with EMODnet Biology have not been as fruitful as expected because it appears that Biology by nature only deals with species, not habitats. Even though Biology intends to make abundance maps of individual species, if these are not “habitat forming” (as e.g. kelp or fucoids), they can hardly be used for thresholds.

WP4	Delays in obtaining the full set of available seagrass meadow cartographic data from eastern Adriatic countries and present unavailability of 250m bathymetry did not enable us to perform light threshold validation based on Posidonia lower limit in the southern and eastern Adriatic. In general, perspectives of obtaining data from third party countries adjacent to our basins seem dull, so we'd better just count on our own. This is an incentive to try and bring these countries into forthcoming projects, in order to get a chance to fill some of the gaps.
WP2	Energy data (currents and waves) were summarised but as they still are too coarse to be used in a homogeneous way, they were left aside for this first set of maps. There is little scope for improvement within project's time frame.

4. Allocation of project resources

Please provide information about the effort (percentage of project resources) spent during the reporting period on the main objectives such as preparing and providing access to data within a country; access data from international sources; providing the data infrastructure to access and make data available across countries; develop standards (INSPIRE, EMODnet, MSFD).

The effort spent by the partners during this first year were not so much allocated to looking for data (as data as mostly provided by other lots) but to research how to deal with new basins such as the Adriatic and the Black Sea. The main challenges were a) the presence of large deltas inducing a specific distribution of both sediment and biological zones, a situation not found in Phase 1, b) the very peculiar conditions prevailing in the Black Sea where EUNIS cannot be applied as such.

The overall effort of the 4 main partners (Ifremer, ISPRA, JNCC and HCMR jointly totalling 68 % of the project budget) was on average 28 %. The effort in collating and preparing data (which covers substrate, habitat, biological and oceanographic data) may amount for the first year at about 18 % of the joint effort. The other 10 % were spent on research, tests and meetings.

Once the new website was set up and integrated with MESH, making the data available in the webGIS portal was a relatively light task as it was limited to uploading the three recent basins requested for year 1. Wherever both depth and substrate data are both available, the maps are EUNIS-compliant.

5. Meetings held since last report

*List here the meetings attended or **organized by EUSeaMap2** since the last report, if relevant add short description*

Date	Location	Topic	Short Description
1-4 Oct. 2013	ISPRA Rome	**EUSeaMap2 kick-off**	Objectives Explain rationale Develop common understanding with newcomers Explain model
16-17 Dec. 2013	Brussels	1st Steering Committee meeting	Introduction of Secretariat, working groups, indicators etc.
14 Jan.		**Skype meeting**	Mid-term progress assessment
22-23 Jan. 2014	Lisbon	Emodnet Geology kick-off	Specifications of WP3 (seabed substrate) as input to Seabed habitats models
19-29 Feb.	Ostende	MODEG	MODEG and inauguration of Secretariat.
17 March 2014		**Skype meeting**	Preliminary discussion on biological zone definition in the Black Sea
6 Apr. 2014	-	**Skype meeting**	Advancement on biological zone boundary definitions and list of habitats (Adriatic and Black Sea)
8-11 Apr. 2014	HCMR Athens	**EUSeamap2 first progress meeting**	Agreement on: - substrate classification - depth zone definition (variations from core definition), - list of habitats to model, Checking applicability of energy and light data
2 Jun. 2014	-	**Skype meeting**	Atlantic basins
6 Jun. 2014	-	**Skype meeting**	Black Sea advancement of work: - Black Sea depth zones - Black Sea list of habitats to model
21 Jul. 2014	-	**Skype meeting**	Progress on interim report preparation

6. Work package updates

WP1 – Classification review

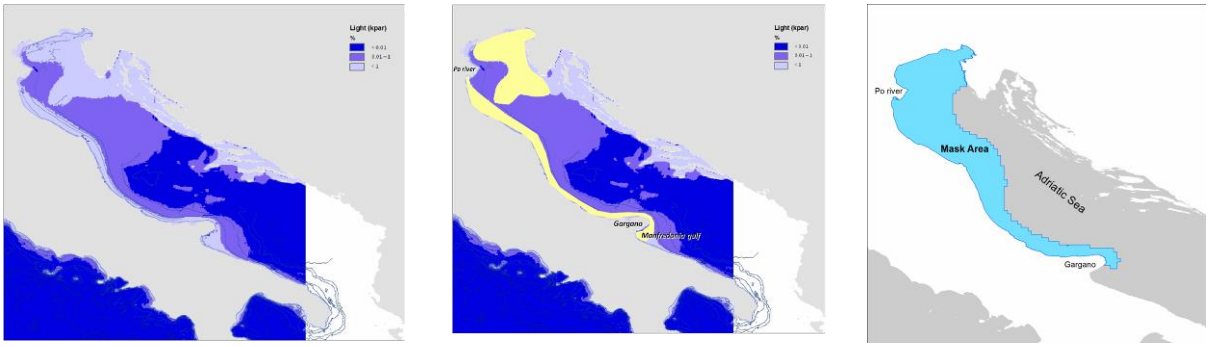
1. Biological zones definition

The work focused on the Mediterranean basin, Macaronesia (Canaries and Madeira) and the Black Sea. For the former, it was recognised that zones as defined in Phase 1 for the western basin would be extended to the whole basin. One notable exception is the geomorphological definition of the bathyal boundaries (shelf break and slope base) which does not hold in tectonically active regions. This means a specific solution will have to be designed in year two. Another exception is also that of masking out areas influenced by high river input (see next section).

Infralittoral/circalittoral boundary

For the Adriatic, the results of a close examination of a number of benthic stations located in the area under River Po discharge influence strongly suggest that the application of the 1% light threshold is an inappropriate method for defining the infralittoral/circalittoral boundary since it defines an infralittoral coastal belt whose extension from the coastline encompasses shallow muddy bottoms that cannot be considered characteristic of the infralittoral zone. This is particularly obvious in the areas indicated in the yellow polygons where the infralittoral zone defined by the 1% light appears overestimated.

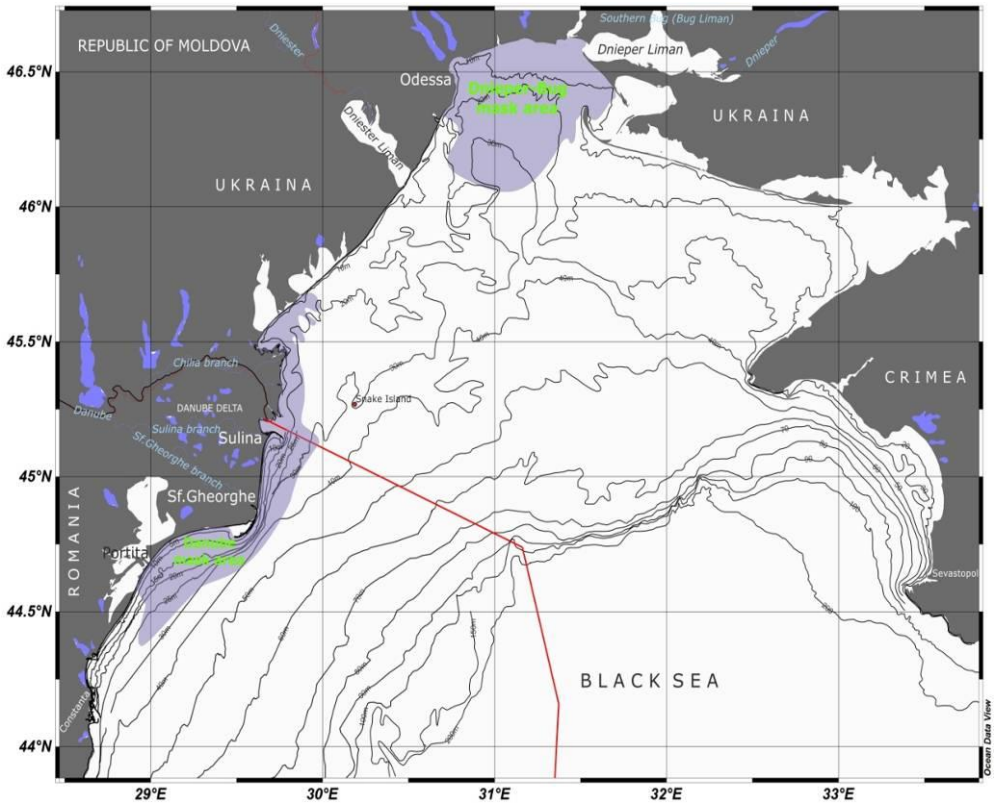
Since the mask area refers to the marine sectors influenced by river inputs, it follows that the definition of the mask boundaries should be based on the abiotic variables linked to freshwater input such as salinity, temperature and turbidity. The distribution of these variables was analysed to find the datasets that best match up the expected spatial definition of the area most influenced by the mud and sandy mud rise into the shallow coastal areas. It was decided that the preliminary version of the mask extension is best defined by specific superficial salinity values. Discussions led to the need to create a mask of this region where the definition of the infralittoral departs from the more general one based on light. Therefore (i) within the mask, on the western side of the Adriatic, the sediment boundary between coastal mud and coarser fractions offshore is going to be used as the infra/circa boundary, (ii) outside of the mask, the use of the 1% light threshold validated by lower limits of Posidonia extension prevails.



Distribution of light attenuation at the seabed in the Adriatic Sea using 1% light threshold (left), area (yellow polygons) where 1% light threshold appears to overestimate the infralittoral zone extension (centre), Outer limits of the mask area to be used in the Adriatic Sea model (right).

In light of the above the infralittoral zone of coastal areas greatly influenced by river inputs such as those of north eastern Italy (influenced by the Po and the remainder of the Appenine rivers) and most of Albania (influence from the Bojana river to the Vjose river further south) should be modelled separately.

Similar work was carried out in the Black Sea, namely for the River Danube plume and the north western Ukrainian coast.



Romanian (Danube) and Ukrainian (Dnieper-Bug) masks.

For Ukraine, the intersection of the 15 PSU isohaline and muddy sediments distribution has also been used to create the mask area (Zaitsev et al, 2006). The substrate distribution is based on the map provided by the National Service of Geology and Mineral Resources of Ukraine (2011, Black Sea Region Geological State, Public Enterprise `Pivdenekogeotsentr`, Chief Editor Shnyukov, E.F.).

For the Canaries and Madere the 1% light threshold was also used.

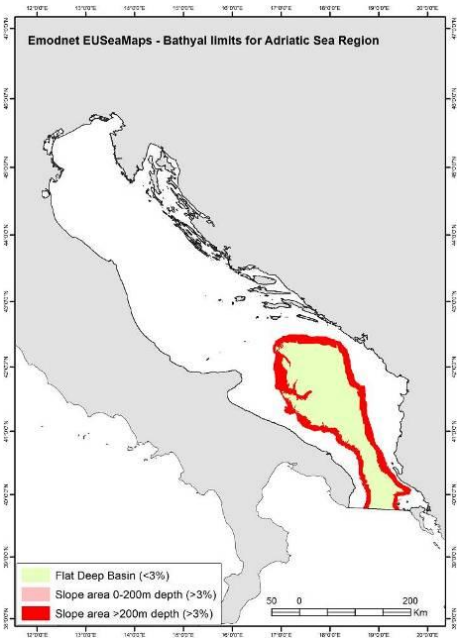
Circalittoral/deep circalittoral boundary

In the Atlantic the EUNIS classification considers two circalittoral sub-zones, namely the circalittoral and the deep circalittoral. The limit used to delineate these two sub-zones is traditionally the wave base, i.e. the limit at which the seafloor is no longer disturbed by waves. For the Canary Islands and Madere the wave base could not be calculated because no data on wave action could be collated during the course of the first year of the project. Instead a depth of 80m was used.

For the Mediterranean EUNIS does not formally consider two sub-zones within the circalittoral. Therefore for the Adriatic Sea it was decided to keep the circalittoral as a single unit.

Bathyal/abyssal boundary

Active discussions were held about the boundary between the bathyal and abyssal zones. This issue has been solved rather easily in the Atlantic and the Western Mediterranean, where active tectonics is rather weak and passive margins dominate. This is not the case in large parts of the Eastern Mediterranean due to the active plate tectonic processes, intense faulting and crustal deformation. Starting with the Adriatic Sea, two scenarios were produced for the definition of the bathyal/abyssal boundary based on bathymetry data. The scenarios were based on the processing of the sloping angle of the seabed deeper than 200m. Two thresholds of 3% and 5% slope were trialled to differentiate the steeply dipping bathyal zone from the flat abyssal plain and finally the 3% value adopted as illustrated on the figure below because it outlines the flat deep basin where no sediment instability occurs.



Seabed area exhibiting slope higher than 3% defining the bathyal zone

In the Canaries and Madere, for this first phase the decision was taken to use simple depth thresholds as upper and lower bathyal zone boundaries, respectively the 200m and 2700m. As for previous similar projects dealing with broadscale mapping of the Atlantic seabed habitats (ur-EUSeaMap, MeshAtlantic), the bathyal zone was divided into four zones, namely the upper slope, the upper bathyal, the mid bathyal and the lower bathyal. Their lower limit was also defined based on depth thresholds, respectively 750m, 1100m, and 1800m.

Definition of EUSeaMap2 biological zones boundaries for the Mediterranean and Black Sea

	Adriatic	Eastern Med. And Levantine	Black Sea NW-W
Biological zone	Upper limit	Upper limit	Upper limit
Infralittoral	Lowest Astronomical Tide	Lowest Astronomical Tide	Lowest Astronomical Tide
Circalittoral	SW-SE-E area: Intersection of seabed and @1% surface light reaching the seabed Masked area: The lowest depth limit of the muddy sand and sand bottoms and rocky coastal bottoms intersected with a maximum depth of 0-15/20m.	Intersection of seabed and @1% surface light reaching the sea bottom	NE-E-S area: Intersection of seabed and 1% surface light reaching the seabed Romanian shore southwards until Burgas Bay: Intersection of seabed where sea bottom hydrodynamics generated by strong storm waves (i.e. 7-8 Beaufort) is no longer present Masked area: The lowest depth limit of the muddy sand and sand bottoms and salinity < 15 PSU.

Bathyal	Shelf edge defined as transition from slope <3% to slope >3% or proxy	Shelf edge delimited by the slope angle change of the continental platform, or proxy	Shelf edge delimited by the slope angle change of the continental platform, or (bathymetry) proxy
Abyssal	Bathyal slope bottom as transition from slope >3% to slope <3% or proxy (bathymetry)	Shelf slope break delimited by the slope angle change of the continental slope, or proxy (bathymetry and gemorphology)	Shelf slope break delimited by the slope angle change of the continental slope, or proxy (bathymetry); Proxy: Bathymetric average of shelf slope break: 1600 m

2. Identification of habitats to be modelled

Mediterranean Sea

Habitats to be modelled within each biological zone for most areas of the Mediterranean will follow the basic scheme developed for the Western Mediterranean in EUSeamap (see the table below which shows a selection of the 27 habitats retained). For the mask area of the Adriatic Sea, modelled habitats will remain at a physical habitat level (i.e. infralittoral sand, circalittoral muddy sand) because the distribution and characterization of biological communities in the area influenced by the high riverine inputs are not well known and hence it is not feasible to attempt to model habitats in this area in terms of an actual biological assemblage.

Examples of EUNIS habitats proposed for the Adriatic /central Mediterranean / Ionian/Aegean/Levantine sea model with key physical variable attributes (table nor complete)

EUNIS code	Eunis habitat name	Barcel. Conv. code	Regional Convention habitat name	Bio. Zone	Light	Z/ slope	Substrate	Energy
A3	Infralittoral rock and other hard substrata	III.6.	HARD BEDS AND ROCKS (biocenosis of infralittoral algae)	INFRA	>1% surface light - *in situ* data	1-45 max	bedrock, boulders and cobbles / ROCK	
A5.23	Infralittoral fine sands	III.2.	FINE SANDS WITH MORE OR LESS MUD	INFRA	>1% surface light - *in situ* data	0-45	fine homogenous granulometry and well sorted fine sands / SAND / MUDDY SAND	
A5.13	Infralittoral coarse sediments	III.3	COARSE SANDS WITH MORE OR LESS MUD	INFRA	>1% surface light - in situ data	0-45	SAND / MUDDY SAND	
A5.23	Infralittoral fine sands	III.2	FINE SANDS WITH MORE OR LESS MUD	INFRA (mask)			SAND / MUDDY SAND	
A5.36	Circalittoral fine mud	IV.1.1.	MUD	CIRCA (mask)			MUD	
A5.35	Circalittoral sandy mud	IV.1.1.	Mud	CIRCA (mask)			SANDY MUD	

A5.26	Circalittoral muddy sand	IV.2.	Sand	CIRCA (mask)			MUDDY SAND	
A5.14	Circalittoral coarse sediment	IV.2.	Sand	CIRCA (mask)			COARSE & MIXED SEDIMENT	
A4	Circalittoral rock and other hard substrata	IV.3	Hard bottoms and rock	CIRCA (mask)			ROCK	
A4.26 & A4.32	Mediterranean coralligenous assemblages	IV.3.1	Coralligenous biocenosis	CIRCA	<1% surface light >0.01% - in situ data	25-100	ROCK	moderate
A5.46	Mediterranean biocoenosis of coastal detritic bottoms	IV.2.2.	Biocenosis of the coastal detritic bottom	CIRCA	<1% surface light >0.01% - in situ data	below P. Ocean. to shelf break	gravel, sand and shell debris / COARSE & MIXED SEDIMENT/ MUDDY SAND / SAND	medium constant current
A5.51	Maerl beds (all Rhodolith beds)	IV.2.2.1; IV.2.2.2	-Association with rhodoliths; Maerl facies (assoc.*Lithothamnion corallioides* and *Phymatolithon calcareum*)	CIRCA	<1% surface light >0.01% - in situ data	25-100 m	COARSE & MIXED SEDIMENT	High-medium constant current
A5.38	Mediterranean biocoenosis of muddy detritic bottoms	IV.2.1.	Biocenosis of the muddy detritic bottom	CIRCA	<1% surface light >0.01% - in situ data	below P. oceanica until shelf break	SANDY MUD	sedimentation slow; low energy

Black Sea

A first tentative list of Black sea habitats has been drawn for Bulgarian, Romanian and Turkish waters. This list is composed of 21 habitats known to be present in the Bulgarian part, 12 in Romania and 20 in Turkey and each one is defined on the basis of the abiotic features and respective values that are known to characterize each habitat. After several iterations between the three countries a list of 16 major habitats (table below, not complete)**,** out of which 62.5% are common to all countries, has been proposed.

A review of the concerted list is still necessary amongst partners so as to avoid listing habitat types having duplicate environmental thresholds. Efforts will be placed to discuss each habitat characteristics and introduce possible overarching parent habitat types that can encompass habitats placed on the list at present and which have threshold parameters that do not allow to univocally model one habitat from the other.

Example of EUNIS habitats proposed for the Black Sea (table not complete)

BG	Bio. Zone	Light	Bathimetry / slope	Substrate	Energy	Salinity
Exposed upper infralittoral rocks with *Cystoseira crinita f. bosphorica Kalug. et Zin. (C. bosphorica Sauv.)*	infra	photophylic, PAR > 40-50%	1- 4 (7) m	rock	high	mesohaline, polyhaline
Moderately exposed upper infralittoral rocks with *Cystoseira barbata + Ulva rigida+ Polysiphonia subulifera*	infra	photophylic, PAR > 10-20 %	1-10 (13)	rock	moder.	mesohaline, polyhaline
Infralittoral rocks with *Ulva rigida + Gelidium spinosum*	infra	photophylic, PAR >10-20%	1 m - lower boundary of euphotic	rock	high, moder.	mesohaline, polyhaline
Infralittoral rocks with *Cladophora* spp. - *Ulva rigida - Ulva intestinalis* - Gelidium *spp.*	infra	photophylic	2 m to lower euphotic	rock	high, moder. ate	mesohaline, polyhaline
Lower infralittoral rocks with *Phyllophora crispa - Apoglosium ruscifloium - Gelidium spinosum - Zanardinia typus*	infra	sciaphylic, PAR 5-15%	10-20 m	rock	moder.	mesohaline, polyhaline
Lower infralittoral rocks with *Polysiphonia elongata +Cladophora albida+ Antithamniom cruciatum + Lomentaria clavellosa*	infra	sciaphylic, PAR 5-15 %	10-20 m	rock	moder.	mesohaline, polyhaline
Infralittoral rock with *Mytilus galloprovincialis* and *Mytilaster lineatus*	infra	not relevant	0.5-20 m	rock	high, moder.	mesohaline, polyhaline
Sheltered infralittoral sand with seagrass beds (five associations in the Bulgarian Black Sea)	infra	photophylic	0.5-10 m	fine muddy sand	low	oligohaline,meso haline, polyhaline
Exposed upper infralittoral coarse to medium sand with *Donax trunculus*	infra	not relevant	0.5-7 m	coarse to medium sand	high	mesohaline, polyhaline
Moderately exposed upper infralittoral medium to fine sand with *Lentidium mediterraneum*	infra	not relevant	2-15 m	medium to fine sand	moder.	mesohaline, polyhaline
Moderately exposed lower infralittoral sand with *Chamelea gallina*	infra	not relevant	5-25 m	coarse to medium sand	high, moder.	mesohaline, polyhaline
Moderately exposed lower infralittoral muddy sand with *Upogebia pusilla*	infra	not relevant	10-20 m	coarse to medium muddy sand	moder.	mesohaline, polyhaline
Shelly organogenic sands	infra/ circa	not relevant	15-55 m	sand	high, moder.	mesohaline, polyhaline
Coastal (sandy) mud with *Melinna palmata, Chamelea gallina, Heteromastus filiformis, Aricidea claudiae*	infra	not relevant	15-25 m	sandy mud	moder., low	mesohaline, polyhaline

Still, we couldn't create a perfect match due to the fact that a couple of habitats could be found in only two countries (e.g., BG and TK) and very few are particular to one country (e.g. Danube mask area). As soon as this stage is finalized the process will be iterated in order for all countries to agree on a unique list more similar in terms of the habitats included. We still should eliminate the fragmentation and the uncertainties related to the lack of clear thresholds for some of the habitats.

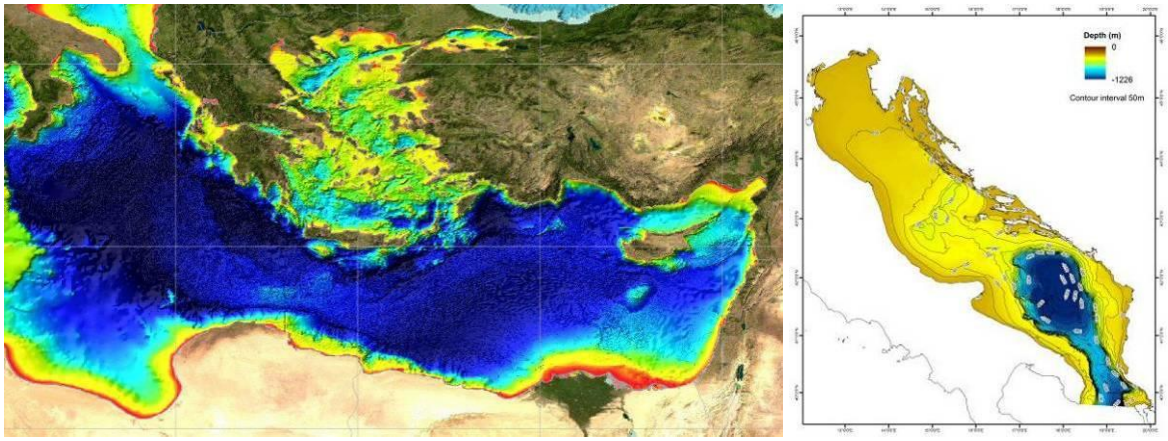
Work is underway to harmonize this list into a final version and define the principal environmental parameters, apart from substrate typology, that will allow their modelling (i.e. gradients of anoxia, salinity and temperature gradients on the seabed).

WP2 – Data collation and preparation

It is the remit of this work package to ensure that data collation progresses at a coherent pace throughout the Partnership and that the right data layers are made available to the project along with their metadata and confidence assessment. WP2 has undertaken and accomplished the following activities during the 1st year of the project.

2.1. Bathymetry

WP2 made available the DTM of the Eastern Mediterranean Sea and Canaries Islands as compiled and delivered by Bathymetry in Phase 1 at resolution of 1/4 minute. The compilation of the new DTM at 1/8 minute (roughly 250m) resolution is in progress by the Bathymetry but has not been made available yet. The new DTM will include new data made available from the partners while GEBCO bathymetry will be used to fill the gaps.



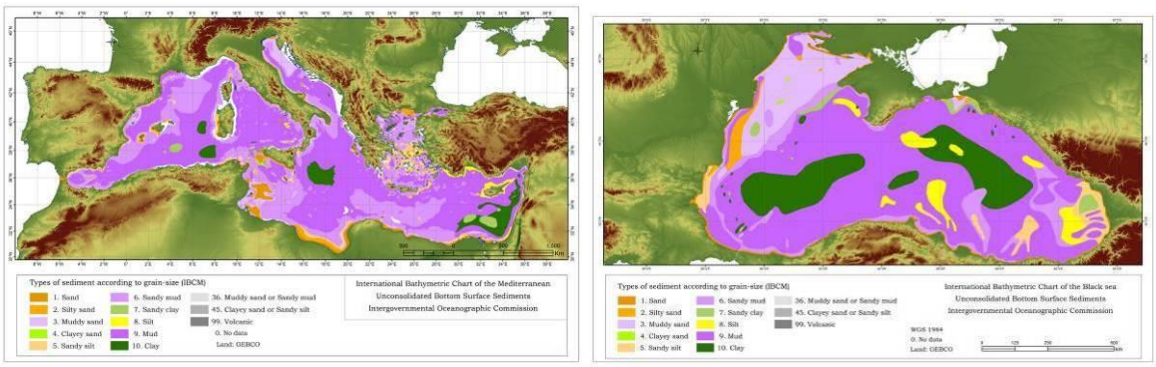
East Mediterranean Sea (left) and Adriatic Sea (right) DTM at 1/4 minute resolution

2.2 Collation of seabed substrate

Substrate data

Seabed substrate layers to be used by EuSeaMap2 largely rely on the delivery by Geology. Data for the Adriatic and Canaries were delivered by Geology on 19 June, while data for Aegean, Levantine and Black Seas are scheduled to be delivered by November 2014. In this first delivery only data at scale better than 1/250000 were provided, leaving out large gaps. The index map provided by Geology along with the data shows gaps for Croatia, Albania, Montenegro and Greece. EuSeaMap2 contingency plan was to digitize the Unesco's International Bathymetric Chart of the Mediterranean (IBCM) for the Eastern Med (inc. Adriatic) and Black Sea to fill the gaps in the priority areas. Still, Albania, Montenegro and

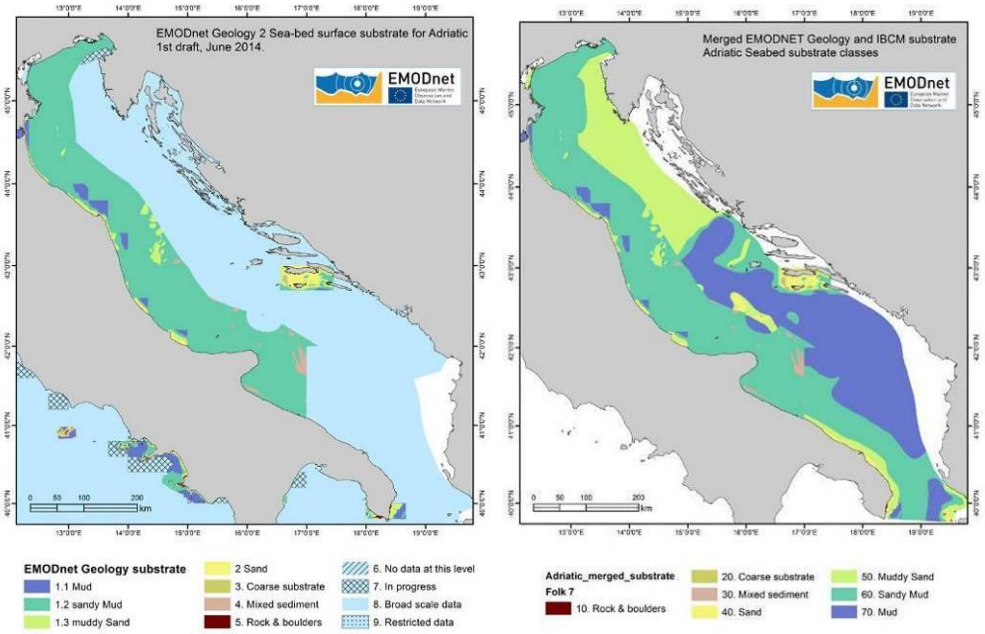
shallow areas north and northwest of Corfu, Greece are not included in the IBCM map either. Along with former work, the whole Mediterranean and Black Sea have been made available to the project before the completion of the present report.



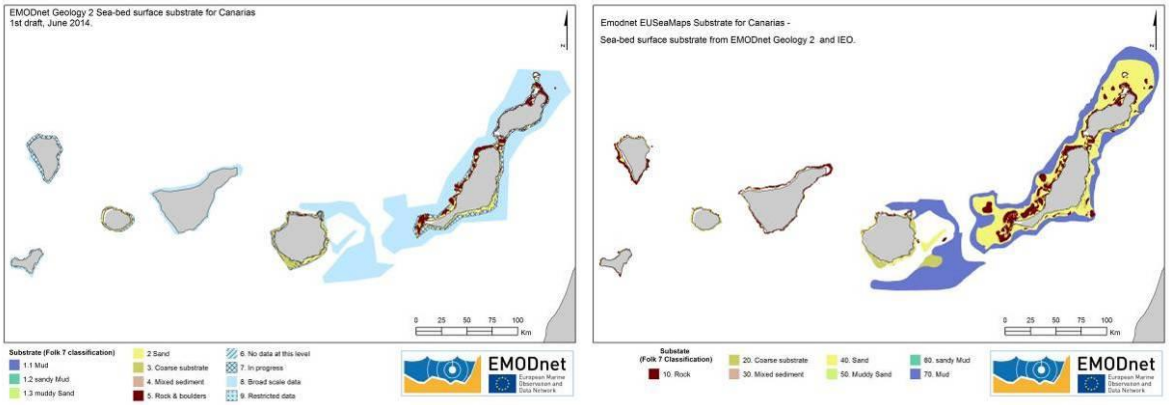
Digitized sediment substrate (grain size) IBCM map for the Mediterranean and Black Seas.

The objective of WP2 was to provide seabed substrate maps at resolution of 1/8 minute for the Adriatic Sea and the Canary Islands by creating two composite maps:

- The substrate map of the Adriatic Sea was compiled from the Geology delivery (western half) and additional IBCM (eastern half). Data on hard bottom was obtained from the Italian MSFD reporting on predominant habitats and inserted into the substrate map. Available *Posidonia oceanica* and *Cymodocea nodosa* meadows maps were acquired for southeastern Italy, Greece (Diapontian islands), Albania, Montenegro and Slovenia. Unfortunately the Slovenian and Montenegrin meadows have a very small extension and as such cannot be incorporated in the 250m pixel resolution of the broad scale map.
- The substrate map of the Canary Islands was compiled by using the Geology delivery plus data provided by IEO.



Seabed substrate map delivered by EMODNET Geology (left), Composite seabed substrate map of the Adriatic Sea with EMODNET Geology layers and IBCM data (right).



Seabed substrate map delivered by EMODNET Geology (left), Composite seabed substrate map of the Canarian Islands with EMODNET Geology layers and IEO data (right).

Folk categories

Geology delivered 7 Folk classes: mud, sand, sandy mud, muddy sand, coarse, mixed plus rock & till). This will involve a new boundary at sand to mud ratio of 9:1 rather than 8:2, a value which was used for the North and Celtic Seas in Phase 1. In the Mediterranean coarse and mixed categories were merged into “mixed sediment”.

The IBCM sediment grain size classification has 12 classes. The correspondence between the IBCM classification and FOLK classification is as follows:

Correspondence table between Folk and IBCM sediment classes

	IBCM	MODIFIED Folk	Med Folk
1	Sand	Sand & Muddy sand	Sand
2	Silty sand	Sand & Muddy sand	Muddy sand
3	Muddy sand	Sand & Muddy sand	Muddy sand
4	Clayey sand	Sand & Muddy sand	Muddy sand
5	sandy silt	Mud & Sandy Mud	Sandy Mud
6	sandy mud	Mud & Sandy Mud	Sandy Mud
7	sandy clay	Mud & Sandy Mud	Sandy Mud
8	silt	Mud	Mud
9	mud	Mud	Mud
10	Clay	Mud	Mud
11	muddy sand or sandy mud	Muddy Sand or Sandy Mud	Muddy Sand or Sandy Mud
12	clayey sand or sandy silt	Muddy Sand or Sandy Mud	Muddy Sand or Sandy Mud
13	Volcanic	---	---

The IBCM maps distinguish only between types of soft sediment and do not contain coarse and mixed sediments nor rocky seabed except from volcanic substrates which occur around volcanic islands in the Tyrrhenian and Aegean Sea. Therefore rocky habitats and coarse and mixed sediments are missing in parts of the Adriatic where gaps were filled with IBCM data.

Furthermore, specific requests had been made to Emodnet geology to provide an additional layer indicating any presence of biogenic/bioclastic components which would have allowed to model specific habitats (i.e. circalittoral detritic) but such information at present is missing.

2.3. Oceanographic data

Objectives and material

The calculation of GIS layers integrating oceanographic variables (e.g. wave-induced energy at the seafloor) over a given time period is an important task of the project. Those layers will enable to attempt to model the habitats for which there is consideration of the energy regime. According to the first year objectives and the focus on the Adriatic, ISPRA performed an assessment of available oceanographic data in the Mediterranean Sea. These were downloaded from the archives of the MYOCEAN project, from the ECMWF archive, and from the ISPRA Mc-WAF system.

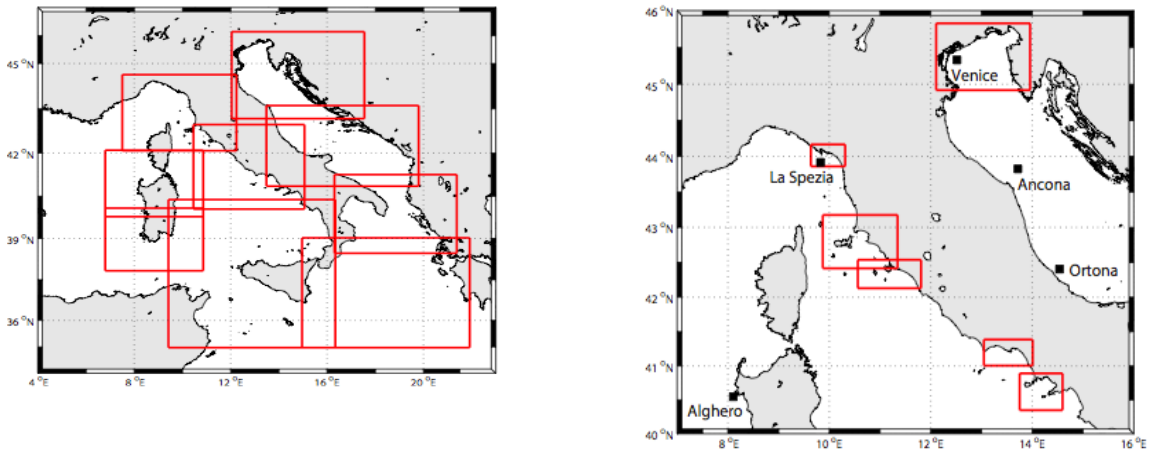
- *MyOcean data*
  MyOcean numerical models (Med Forecasting System) for the Mediterranean Sea were used. Current, temperature and salinity data are given on a regular grid with a

cell size of 1/16° for both latitude and longitude.

- *ECMWF MED*
  Since July 1992 the European Centre for Medium-Range Weather Forecasts (ECMWF) runs two models, one for the global ocean and one for the Mediterranean Sea. The latter uses the 0.25 degree irregular lat-long grid. The period considered in this report starts from September 2012 to June 2014.
- *ISPRA Mc-WAF*
  Mediterranean-Coastal_WAve Forecasting (Mc-WAF) is an operational tool designed to merge different scales for the generation and propagation of the wave energy in the Mediterranean Sea. It works on three levels of nesting: i) a domain covering the entire Mediterranean at 1/30° resolution, ii) 9 regional areas surrounding Italy at 1/60° resolution, and iii) coastal areas at very high resolution, from 400m in the Tyrrhenian Sea to 200 m in some test areas in the northern Adriatic (figure below). The bathymetry used for Mediterranean domain is the general Bathymetric Chart of the Ocean (GEBCO) at 30 arc-second grid resolution, which is locally corrected in regional and coastal areas using the Istituto Idrografico della Marina (IIM) digital maps.

Results

The outcomes achieved in the first year of the project were: i) an estimate of kinetic energy at the seabed and at the surface due to wind-waves and currents in the Mediterranean Sea, ii) the estimation of the salinity and velocity in the same areas. Data files have are produced as shapefiles or NETCDF geo-referenced files. The methodology used for the calculation of those outcomes as well as a preliminary analysis is available in a technical appendix drafted by ISPRA.



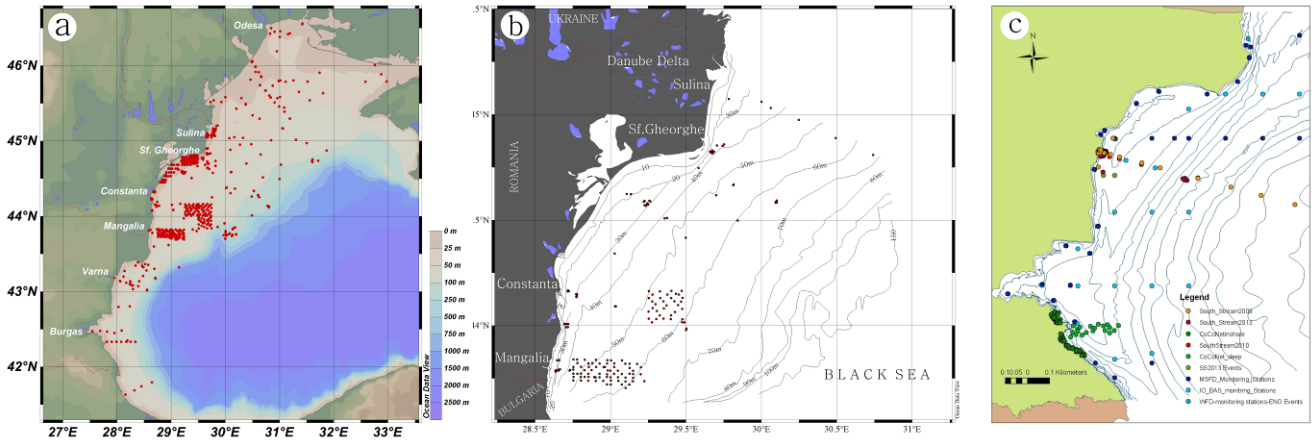
Left: ISPRA Mc-WAF regional areas, Right: ISPRA Mc-WAF Coastal areas.

WP3 - Collation of biological samples data

The main objective of this WP is the collation of habitats occurrence samples. This WP is focused on gathering available information on the spatial distribution of habitats or communities, to complete the inventory of existing holdings of marine data in collaboration with the consortium partners. The collation of habitat occurrence samples is crucial to perform the validation of the EUNIS categories thresholds.

3.1 Black Sea

The activity of collation of habitats occurrence samples has been focused on the north-western Romanian and Bulgarian shelf. A general map showing all Romania biological sampling points is presented, including *Mytilus* beds found during the national monitoring (transects and perimeters) and international expeditions, data covering about 30 % of the *Mytilus* areal in circalittoral. Bulgarian groundtruth data on zoobenthos community are based on 250 sampling points performed during monitoring and projects surveys.



Left: Zoobenthos sampling points (NW, W shelf), Centre: Mytilus galloprovincialis groundtruth data (Romania), Right: zoobenthos sampling points (Bulgaria).

In order to have a complete image of the data availability we started to make an inventory of biological samples found in different types of habitats in the Black Sea. As soon as the list of common habitats is agreed at regional level (in the first phase, between Romania, Bulgaria and Turkey), biological samples will be used to perform the validation of the EUNIS categories thresholds and the habitats distribution accordingly.

In the table below is given an example of biological samples compilation based on data availability in GeoEcoMar archive. The following information is provided: the sampling point location (station), the station indicative, geographical coordinates, bottom depth (m), the number of samples per station, the habitats occurrence samples, the EUNIS code (the habitats are shown only as example). One more column could be inserted concerning the QA/QC of data acquired.

Example of habitat occurrence samples (Romania)

Transect	Station	Data	Longitude E	Latitude N	Bottom depth, m	Samples ZBT	EUNIS habitat	EUNIS Habitat code
Sf. Gheorghe	10SG01	19.05.2010	29°39'05.5260"	44°49'45.3240"	16,27	2	Pontic fine and muddy sands with [Mya arenaria]	A5.237B
Sf. Gheorghe	10SG02	19.05.2010	29°39'47.3640"	44°49'36.1020"	24,78	2	Pontic sandy mud with [Melinna palmata]	A5.337
Sf. Gheorghe	10SG03	19.05.2010	29°40'34.5960"	44°49'27.5460"	33,41	2	Pontic sandy mud with [Melinna palmata]	A5.337
Sf. Gheorghe	10SG04	19.05.2010	29°48'56.1000"	44°40'09.9900"	50,23	2	Pontic circalittoral sandy muds with [Heteromastus filiformis], [Dipolydora quadrilobata] and [Nephthys hombergii]	A5.356
Sf. Gheorghe	10SG05	19.05.2010	30°06'05.8260"	44°35'18.9900"	60,8	2	Pontic deep circalittoral muds with [Modiolula phaseolina]	A5.379
Sf. Gheorghe	10SG14	19.05.2010	30°18'42.7500"	44°27'53.8800"	73,65	2	Pontic deep circalittoral muds with [Modiolula phaseolina]	A5.379
Sf. Gheorghe	10SG06	18.05.2010	30°31'24.0180"	44°20'11.3700"	88,02	2	Pontic deep circalittoral muds with [Modiolula phaseolina]	A5.379
Sf. Gheorghe	10SG07	18.05.2010	30°36'35"	44°16'83"	98	2	Pontic deep circalittoral muds with [Modiolula phaseolina]	A5.379
Sf. Gheorghe	10SG08	18.05.2010	30°36'44.3100"	44°14'37.7760"	114,5	2	Pontic periazoic white calcareous muds with [Bougainvillia ramosa] and nematodes	A5.37C
Sf. Gheorghe	10SG09	18.05.2010	30°46'59.8680"	44°09'06.5700"	143,4	2	Pontic periazoic white calcareous muds with [Bougainvillia ramosa] and nematodes	A5.37C

3.2 Other basins and contacts with Biology lot 5

In the Atlantic basins the search for biological data has started at a slower pace because the revision of thresholds was not a priority. However the principle of a joint investigation of the light threshold indicating the photic zone was agreed on at the fist progress meeting in Athens. On the basis of individual investigations undertaken earlier in several countries (France, Portugal, UK), the presence of Norway and its kelp-covered rocky shore was an incentive to revisit the light threshold in a more global way across basins. A new element is also the wish to look at energy itself rather than a percentage. Ground truth data collation is underway.

In the first part of July GeoEcoMar contacted Simon Claus, in charge of Biological Lot 5 and sent him the list with species/stations that would help us gather data about the communities distribution in the Ukrainian part. We asked him also to provide the abiotic parameters (if they are available in the EurOBIS database) and spatial data associated with those species.

More generally, contacts initially taken with Biology have not been as fruitful as expected on account of there being quite a step from species to habitats and it was found out that Biology by nature only deals with the former. Only the distribution maps of “habitat forming” species might be relevant for our validation process.

WP5 – Modelling and Confidence

The purpose of this work package is to give an account of how the models are run and updated and also to develop confidence layers for the broad-scale habitat map and input physical layers.

5.1 Production of the broad-scale map for three basins

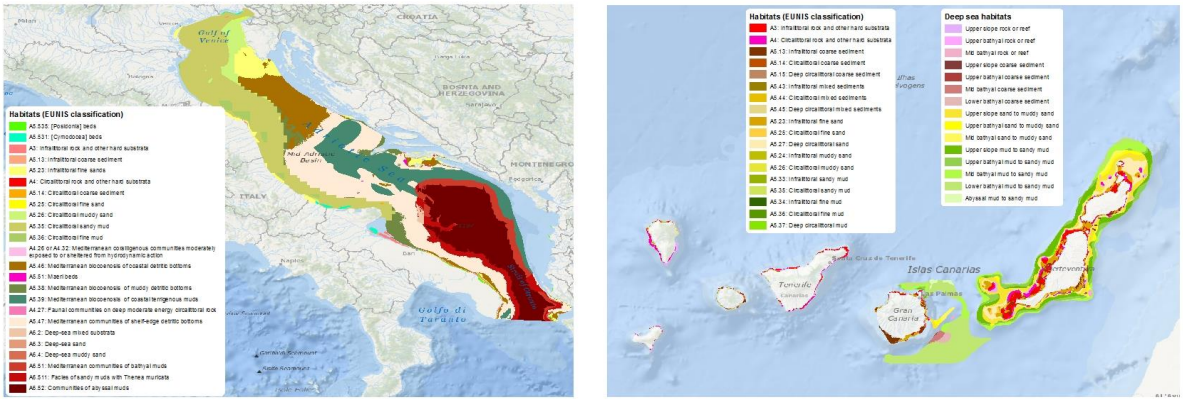
It was earlier agreed that the three new basins with respect to phase 1 were Biscay and Iberian Peninsula, Macaronesia and the Adriatic. The first is already available and needs no update for the time being. The second consists of the Azores, also already available, Madeira and the Canaries.

The project developed the approach used in previous similar projects (MESH, ur-EUSeaMap, MeshAtlantic). This approach is a combination of several variables through the use of raster layers in a Geographical Information System (GIS) environment. The main data layers to be used are commonly: i) seabed substrate, ii) biological zones, and iii) specific abiotic parameters such as energy/light conditions at the seafloor. These data layers are divided into classes equivalent to the EUNIS level 3 or 4 types.

For the Canary Islands no energy data could be collated during the course of the first year of the project. Therefore the sublittoral rock habitats were mapped at level 2 of EUNIS (instead of the usual level 3), i.e. 'A3: Infralittoral rock and other hard substrata' and 'A4: Circalittoral rock and other hard substrata'.

In order to obtain a habitat map from the various inputs (substrate types, bathymetry, light attenuation (K_{DPAR}), etc.), a series of GIS processing steps have to be executed. For example the polygon layer of substrate types provided by the EMODnet Geology lot has to be converted into a raster layer; the K_{DPAR} layer has to be combined with the bathymetry layer in order to obtain the layer of percentage of light reaching the seabed, which itself is an input of the processing that calculates the infralittoral zone extent; etc. All those processing steps are saved as workflows that can be replayed when an input update is available.

Screenshots of the habitat maps for the Canary Islands and the Adriatic are shown in the figure below. For Madeira, no data was delivered by the EMODnet Geology lot. Therefore, whilst a biological zone map could be produced for that area, it was not possible to make a habitat map.



Habitat map for the Adriatic (left) and the Canary Islands (right).

5.2 Confidence assessment

The main factors that affect confidence in predicted habitats maps are (A) the relevance of the variables used to predict habitats; (B) the quality of the input layers in terms of

resolution and accuracy; and (C) the certainty in the threshold values used for the classification of the input physical layers. In year 1 of the project, we have investigated the feasibility of assessing confidence with respect to these factors in a consistent and meaningful way across the basins. A summary of our investigation is provided here.

Relevance of variables used (factor A)

The EUNIS habitat classification system provides guidance but does not prescribe clear rules for which physical variables control the distribution of communities within all biological zones. In reality it can be a combination of factors, and it must be kept in mind that the EUSeaMap mapping process simplifies the situation by choosing usually a single variable to define a biological zone boundary, assuming all other things are equal, for example, using a depth contour to define the boundary between some deep-sea zones, when the boundary is likely to be affected by multiple factors including temperature and salinity. It is not feasible to map the resulting loss of confidence resulting from this uncertainty; however, it is something to consider.

Methods for assessing confidence: Validation of final habitat map (assesses all factors)

The quality of the final output map could be evaluated by comparing the predicted habitats with habitat distribution maps from surveys, where available. The model output validation with survey maps was attempted in the West Mediterranean in the first phase of EUSeaMap. This method provides a general estimate of the model performance (i.e. percentage agreement between predicted and in situ data, 61% in the West Mediterranean), but not a full-coverage confidence map (i.e. a confidence value for each cell). This is because in-situ habitat maps cover a small percentage of the mapped seabed. Furthermore the general lack of ground truthing data points, especially for some habitat types (in the deep sea, for example) affects the validation process. Finally, because the predicted map is at a broader scale than that at which the habitats vary in reality, comparisons with in-situ data tend to underestimate the map confidence. For these reasons this is not considered to be a reliable method for the creation of full coverage habitat confidence maps in EUSeaMap phase 2.

Methods for assessing confidence: Confidence in class membership based on uncertainty in the input layers (assesses factor B)

The uncertainties associated with the contributing data layers (themselves being models) can be analysed statistically to obtain a quantitative, probabilistic measure of confidence in the membership of a class, e.g. moderate energy. E.g. if a cell value is 25±5 and the threshold between two classes is set at 30, then the probability of being in the lower class is 100%, but if the cell value is 25±10 the probability of being in the lower class is 75%. However, this method can be used only where information on data quality and uncertainties

in input layers is available.

The creation of a probability layers involves a detailed statistical study of uncertainties. This is based on statistics of uncertainties of the modelled physical variable from comparison with in-situ observations and ultimately the calculation of the probabilities of each given value to belong to a certain habitat class. A similar approach has been used in the UKSeaMap 2010 project[1]. Assessing the confidence in input layers via such an approach requires that all contractors that are involved in the derivation of physical layers, such as light or kinetic energy, also provide an uncertainty layer. In some regional seas a quantitative assessment of uncertainties in the input layers cannot be produced due to the lack of sufficient physical in-situ observations (for example wave data in the East Mediterranean, or Iberia and French Atlantic).

The Greater North Sea and Celtic Seas have been identified as possible "pilot" areas where in-situ data are sufficient to test the quantitative approach. However an uncertainty layer is not currently available for the current energy layer (updated in 2012). The application of this method will require the purchase of a new energy model with associated uncertainty. Similarly no uncertainty information is available for the current light layer.

Methods for assessing confidence: Qualitative assessment of input layers (assesses factor B)

As observed in EUSeaMap 1, for the primary seabed substrate data layer confidence cannot be assessed quantitatively, because of the categorical nature of the data. Categorical substrate data will also be used in EUSeaMap (as provided by the Geology lot). We are expecting a qualitative confidence assessment to be provided by the geology lot, based on survey and interpretation techniques used in the formation of the map.

Methods for assessing confidence: Confidence in class membership based on uncertainties in thresholds (assesses factor C)

Another important component of the confidence estimation is the assessment of uncertainties in the threshold values used for the classification of the physical layers (e.g. kinetic energy) into the environmental categories considered by EUNIS (e.g. "high energy"). This links closely with WP4 (Thresholds). Ideally, thresholds should be based on an assessment of the correlation between the variable and the occurrence of a reference species or habitat. One of the clearest relationships is between the proportion of light at the seabed (based on light attenuation and depth) and the presence of kelp habitat on rock,

[1] UKSeaMap 2010 project: McBreen, F., Askew, N., Cameron, A., Connor, D., Ellwood, H. & Carter, A., 2011. *UKSeaMap 2010: Predictive mapping of seabed habitats in UK waters.* JNCC Report, No. 446. Available at: http://jncc.defra.gov.uk/page-5955.

which can be used to define the lower boundary of the infralittoral zone in Atlantic waters. There are several factors that can lower the confidence in the chosen threshold value, including: A) A lack of biological reference data can mean the value of the variable used as the cut-off (e.g. the proportion of light at the seabed) is uncertain; B) Some variables, such as energy, do not always have a clear reference species or habitat to help define the boundary although there might be a general understanding of how the variable affects the habitat type; C) Low resolution of the physical data layer.

In EUSeaMap 1, layers were created showing confidence in class membership based on uncertainty in thresholds (otherwise known as fuzzy boundaries), e.g. if a cell value = 25 and the threshold between two classes is given as 30±5, then the probability of being in the lower class is 100%, but if the cell value is 30 the probability of being in the lower class is 50%. This was determined using a combination of expert judgement and analysis of histograms. In EUSeaMap 2 we plan to improve the assessment of fuzzy boundaries by using data from a variety of regions, where available, identifying more reference species and investigating more sophisticated methods of determining the width of the fuzzy boundaries, such as General Addictive Modelling, which can model the probability that a sample is classified within a certain class (ie infralittoral, high energy etc), as a function of a physical variable, thus helping to define statistically the location of thresholds and fuzzy boundaries. A workshop on thresholds is planned for the next progress meeting, at the end of Oct. 2014.

Methods for assessing confidence: Combining approaches

To aid understanding of the confidence in the overall habitat map, it is desirable to have a single confidence layer to accompany it. However, the main barrier to this is the combination of qualitative (e.g. substrate) and quantitative (confidence in class membership) techniques used for the various input layers.

Summary

In summary we will continue to assess source layers using a qualitative scoring approach, the details will depend on the assessment of quality on the primary layers (provided by the other lots). The quantitative approach requires a large amount of in-situ physical data, it cannot be applied in every regional sea and it also requires that all contractors that are (or have been) involved in the derivation of physical layers also provide uncertainty information. Efforts will be concentrated on improving biological relevant fuzzy thresholds in the next year of the project.

WP6 – Web portal

The purpose of this work package is to provide a comprehensive user-friendly portal for European seabed habitat maps.

A new emodnet-seabedhabitats.eu website has been created and is currently online. The homepage and content pages have been designed following the EMODnet style guide[2] and the Secretariat's draft recommendation for the harmonisation of the thematic portals[3]. New functionalities have been added including the EMODnet portal RSS news feed and links to the EMODnet Facebook, Twitter and Linkedin pages.

The content pages have been updated to include achievements so far and the work planned for EUSeaMap phase 2. The MESH website has been subsumed, and the relevant content of the old EUSeaMap and MESH portals combined. The interactive map, with new branding, has been updated to allow users to view and download:

- EUSeaMap phase 1 (2009-2012) contents (input layers; regional and harmonised habitat maps; confidence maps);
- The latest EUSeaMap maps (Canary Islands, Black Sea, East Mediterranean)
- MESH habitat maps from surveys
- MESH Atlantic broad-scale map and habitat maps from surveys.

For details about the usage of the web portal, see section 9.

WP7 – Use of Maps

An activity taken on board by EUSeaMap 2 is to map and review various types of uses of broad-scale seabed habitat maps in a ecosystem-based management context. This work will follow up on an almost similar work in EUSeaMap 1 (Cameron & Askew 2011), but is expected to include a significantly wider range of examples and best practices to address. Further, the planned work will also put emphasis on the consequences of the scales applied when mapping broad-scale seabed habitats in order to analyse where there potentially are any critical or optimal spatial resolution to consider or apply.

7.1 - Introduction

Mapping broad-scale seabed habitat is an activity in its own right. So far, significant progress has been achieved in many region of Europe, e.g. the Baltic Sea, North Sea, large parts of the North-east Atlantic Sea and in the western Mediterranean (Cameron & Askew 2011). Seabed maps have multiple uses. But in recent year it has become evident that they are a prerequisite for implementation of the Marine Strategy Framework Directive (Anon. 2008) and perhaps in a wider perspective for the implementation of the Ecosystem Approach. Based on examining past projects, two key questions will be addressed: (1) Where are we now and (2) where are we going?

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[2] Van Houten, M. (MARIS), 2010. EMODnet Style guide.(EMODNETstyleGuide,pdf)

[3] EMODNET Seacretariat, EMODnet Portals: Discussion document on guidelines for the further harmonization of the thematic portals

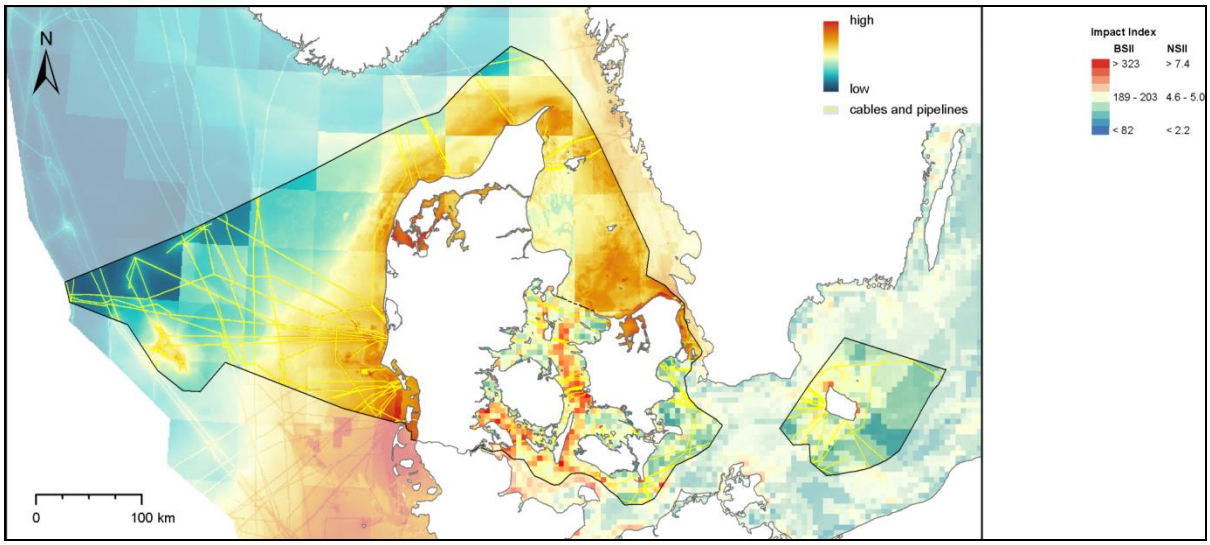
7.2 - BALANCE

The two precursors of broad-scale mapping were two Interreg projects, namely MESH and BALANCE (roughly 2055-2008) respectively addressing the Interreg north-west area and the Baltic Sea. The resulting maps were broadly used in the UK at national/regional level. The BALANCE broad-scale seabed maps have been also widely used and should be seen as a catalyst of a wide range of down-stream activities and products such as: (1) data driven analyses in regard to designation of Marine Protected Areas in the Baltic Sea, (2) mapping of the potential effect of multiple human activities, pressures and impacts in the Baltic Sea (HELCOM 2010, Korpinen et al. 2012), (3) similar activities in the North Sea (Andersen & Stock 2013), (3) updated maps of broads-scale seabed habitats (Cameron & Askew 2011, EUSeaMap 2), and (4) initial assessment of physical modification of the seabed.

Although not widely recognised, is should be emphasised that a number of activities would not have been possible - at the time they took place - without BALANCE, e.g. the mappings of potential cumulative effects of multiple human activities in the Baltic Sea (HELCOM 2010, Korpinen et al. 2012) and the North Sea (Andersen & Stock 2013).

7.3 - HARMONY

HARMONY, or in full "Development and demonstration of Marine Strategy Framework Directive tools for harmonization of the initial assessment in the eastern parts of the Greater North Sea sub-region", was a project aimed towards development of informed marine assessments and management tools for the North Sea. The overall objective of HARMONY (2010-2013) was to develop and demonstrate MSFD tools for harmonization of the initial assessment in the eastern parts of the Greater North Sea sub-region.



Composite map of the potential cumulative effect of multiple human activities in Danish marine waters. The majority of ecosystem components in this type of map are broad-scale seabed habitat maps from Al-Hamdani & Reker (2007) and Andersen & Stock (2013). From Naturstyrelsen (2013).

The challenges of HARMONY were twofold. The first challenge was to establish an overview of ecological information and harmonize it across the eastern parts of the Greater North Sea sub-region and thus support Member States in the implementation of the MSFD. The second challenge was to understand and quantify the spatial distribution and intensity of human activities in order to evaluate the trade-off between impacts and safeguarding of marine ecosystems and thus support the implementation of the MSFD. Hence, HARMONY has put emphasis on: (1) Development and testing of tools for characterisation and assessment of 'environmental status', including thematic tools for integrated assessment of 'eutrophication status', 'chemical status' and 'biodiversity status', and (2) Developing and testing tools for characterization of cumulative human pressures and impacts.

Besides, HARMONY has had a profound influence on the production of MSFD Initial Assessments in Denmark, Germany, Sweden, first of all in regard to the cumulative impacts assessment. So again, without seabed habitat maps, only little progress could have been made.

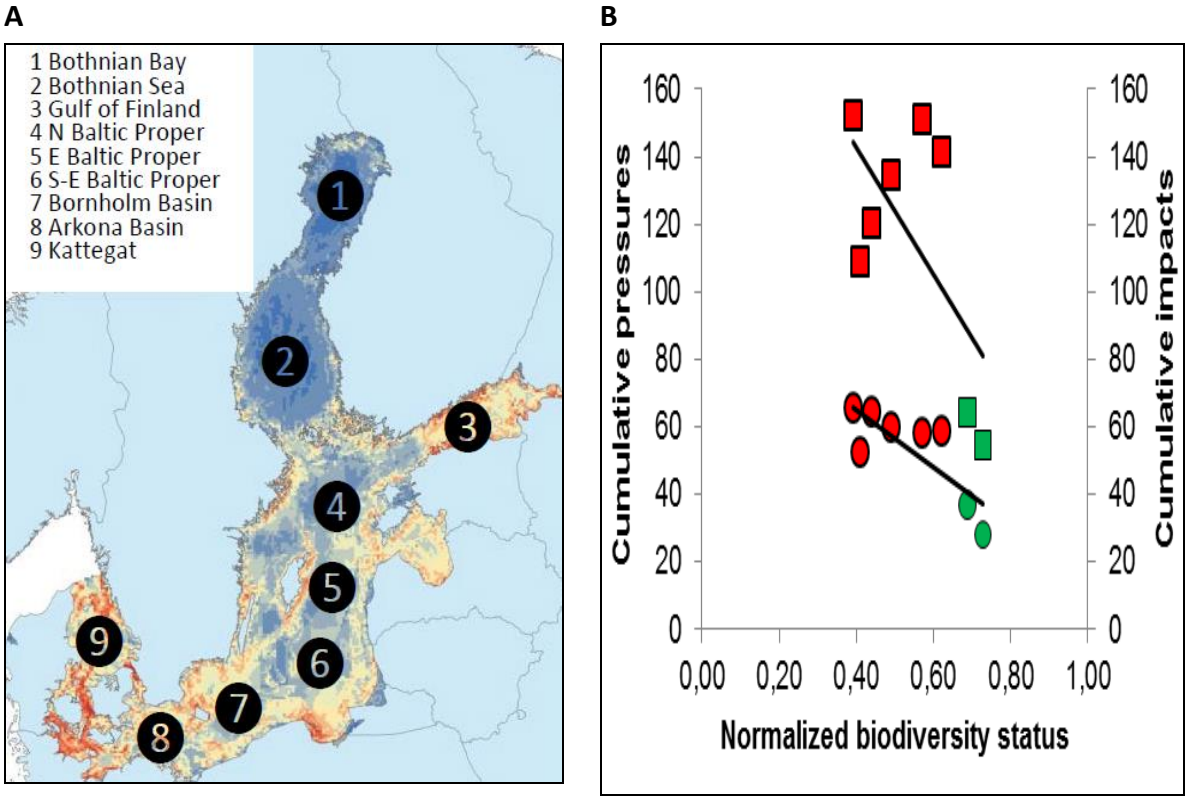
7.4 - STAGES

The purpose of the STAGES project, or in full "Science and Technology Advancing Governance on Good Environmental Status", has its origins in the research questions addressed in the European Coordination and Support Action "The Ocean of Tomorrow" programme topic (ENV.2012.6.2-5). This topic aims to improve the scientific knowledge base to support the implementation of the Marine Strategy Framework Directive. The STAGES project aims to connect science to policy to help achieving Good Environmental Status (GES) in European marine waters.

The aim of this pilot study was to test complementary approaches to model and assess the impacts of concurrent and cumulative pressures, in order to address the need to develop tools to selecting management measures when facing trade-offs between different targets and measures. We explored how the integration of knowledge on causal links and cumulative effects of different pressure reduction scenarios could be used to demonstrate the level of pressure decrease required to improve the state of the marine environment. This study was focusing on nutrient enrichment (eutrophication) and fishing pressures in the Baltic Sea as these two anthropogenic pressures are the main factors, together with climatic variation, that cause changes in the Baltic ecosystem.

The methodology applied in the STAGES pilot study is summarised here: Integrated status of biodiversity in the Baltic Sea has been assessed by the Regional Sea Convention of the Baltic Sea (HELCOM) by a multi-metric assessment tool BEAT 2.0 and agreed as a part of the holistic assessment of the region (HELCOM 2010). The tool builds on four elements (habitat, community and species level and supporting indicators), which include indicators and targets for good environmental status. Biological quality status (weighted average of indicators) was calculated for each element and the biodiversity status (Figure below) is the average of the four elements. An overall status score equal to 1.0 marks the boundary between good (acceptable) and moderate (unacceptable) biodiversity status. Data for the indicators cover mainly the period 2001-2007. Cumulative impacts for a 5km × 5 km grid were estimated according to Halpern et al. (2008) and Korpinen et al. (2012). The value of cumulative

pressures follows the same formula, but without E and µ is an average over all the ecosystems. The pressure data covers the period 2003-2007 with a bias towards latter years.



*Panel **A**: Map of the Baltic Sea and the nine sub-basins included in the study. Panel **B**: Correlations of the Biodiversity status in eight sub-basins of the Baltic Sea by the BEAT 2.0 and the average pressure index score (circles) and impact index score (squares). The correlation does not include the data point for the Northern Baltic Proper, where the partially naturally occurring benthic anoxia causes dead seabed, while human activities do not otherwise cause high pressure. The green points indicate good environmental status in two sub-basins according to the BEAT tool and HELCOM (2010).From Korpinen et al. (2014).*

Based on the data behind these figures, we are currently analysing the data with the aim of identifying any thresholds or criteria above which a 'favourable conservation status' or 'good environmental status' is unlikely. Preliminary results indicate that such criteria can be identified and subsequently used for protection of Marine Protected Area or conservation purposes (i.e. the average cumulative pressure should be reduced to below a certain value in order to achieve conservation targets - Andersen et al. 2014). Clearly, without seabed habitat maps correlations such as these could not have been documented.

7.5 - Pegaso

Understanding where multiple pressures are occurring, their principal source and how they impact marine and coastal ecosystems is essential to support management strategies and is a requirement of the developing marine policies (Marine Strategy Framework Directive, EcAp MAP). At present, an integrated qualitative and quantitative understanding of the relationship between pressures and

impacts in the marine environment is far from being achieved. In 2007, Halpern et al. provided a way to predict ecosystem response to pressures using expert knowledge. Using this methodology and its developments in more recent studies, a cumulative impact map was created by the FP7 Pegaso for the Western Mediterranean Sea (Spain, France, Italy, Morocco, and Algeria). Not only was this approach consistent and comparable across all marine regions and sub-regions, but it was also expected to enhance the cross-boundary cooperation between EU and non-EU countries assessing the availability of harmonized data for this area (which is a strong argument to extend and refine EUSeaMap at basin borders with adjacent countries where gaps are more salient).

The distribution of benthic habitat used in Pegaso was mainly based on EUSEAMAP (Cameron, A. and Askew, N. 2011). Two other works on cumulative impacts had already been developed similar broad-scale maps (Korpinen et al, 2012; Andersen and Stock, 2012), respectively in the Baltic Sea and in the North Sea. Both projects used a generic habitat classification defined by substrate type and light availability (Aphotic/Photic mud, sand or hard bottom) instead of the original EUSEAMAP classification. As for those studies we had to define a new classification in order to reduce the original number of classes proposed in EUSEAMAP in order to reduce the high number of habitat-pressure combinations (originally 20 habitats × 22 pressures). We had the choice either to merge some classes of the EUNIS nivel 4 classification based on their response to pressures, either to use the same kind of generic classification used in the Baltic and North Sea Studies. This kind of generic classification has the advantage to be more realistic in the sense that when experts judge the vulnerability of the habitat, they will take into account only the measured parameters defining this habitat (light availability and sediment type) whereas with the EUSEAMAP classification, they will judge the vulnerability of an habitat which is a prediction and may not be present in reality.

Finally it has been decided to keep the EUSEAMAP/EUNIS classification for 2 main reasons: a) It should be easier for experts to judge the vulnerability of historically studied habitats with a classification already used in the literature; and b) the obtained vulnerability will be usable if and where monitoring based data on benthic habitats become available. The detailed list of habitats considered in this study is available in the table below.

Table 3.2: Ecosystem component datasets considered in this study (type, availability and origin).

Ecosystem component	Data origin/public availability (In blue when publicly available)	Type of data
Littoral		
Sandy beaches and dunes	Annexe 2	Analysis of Earth observation product (line with presence/absence)
Rocky shores	Annexe 2	Analysis of Earth observation product (line with presence/absence)
Coastal wetlands (Salt marches, Salines, Intertidal flats)	Annexe 2	Analysis of Earth observation product (presence/absence)
Estuaries	Annexe 2	Analysis of Earth observation product (line with presence/absence)
Coastal lagoons	Annexe 2	Analysis of Earth observation product (presence/absence)
Seagrass beds		
Posidonia Oceanica	EUSEAMAP/RACSPA Annexe 2	Compilation all the cartographic information available for this habitat type
Cymodocea nodosa	EUSEAMAP	Compilation all the cartographic information available for this habitat type
Specific deep water seabed ecosystems		
Canyons	Harris and Whiteway, 2012	Interpretation of the ETOPO1 bathymetric grid
Seamounts	RACSPA	
Broad-scale benthic habitats and their communities		
Infralittoral sand and coarse sediments	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Infralittoral mud and sandy mud	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Infralittoral rock and other hard substrata	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Coralligenous and shelf edge rock	EUSEAMAP	Modelisation based on physical and

		morphosedimentary parameters
Mediterranean biocenosis of coastal detritic bottom	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Mediterranean communities of muddy and shelf edge detritic bottoms	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Mediterranean communities of coastal terrigenous muds	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Bathyal hard beds and rocks	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters
Abyssal and bathyal muds, sands and mixed substrata	EUSEAMAP	Modelisation based on physical and morphosedimentary parameters

7.6 Where are we now and where are we going?

Currently, we are building up an overview of the availability of broad-scale seabed habitat maps in Europe and also how these maps are planned to be used, e.g. in regard to the MSFD or regional action plans such as the HELCOM Baltic Sea Action Plan. The planned work in regard to the importance of the scales applied when mapping broad-scale seabed habitats has not yet started. It is planned to begin early 2015, when high resolution seabed habitat maps become available.

In EUSeaMap 2, we are gradually building up a catalogue of best practices in application of broad-scale seabed habitats in a management context. Currently, the inputs to the catalogues are mostly from Northern Europe (i.e. the Baltic Sea and North Sea), but with EUSeaMap 1 and EUSeaMap 2 results both being used or emerging, we anticipate to be able to carry out a pan-European review including results and application from all four Regional Marine Conventions.

Having tentatively identified a criterion above which biodiversity is unlikely to be classified as ‘favourable’ or ‘good’ in the Baltic Sea (Andersen et al. 2014), we hope to be able to carry out the same type of analysis in other relevant areas where data fit for purpose might be available. Further, based on the above outlined pan-European review, we will not only hypothesise that broad-scale seabed habitat maps are a prerequisite for the implementation of a management strategy based on the Ecosystem Approach to management of human activities but also analyse, discuss best practices in the application of broad-scale seabed habitat maps. Ultimately, our quest is to document that evidence-based ecosystem-based marine management, in particular Member States’ implementation of the MSFD, pending availability of high quality seabed habitat maps.

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WP8 - Management

Management during year 1 has mostly consisted in engaging the partnership together to achieve the work according to the contract. After a preliminary period of 6 months to get a common understanding and have the consortium agreement signed, the project took its momentum and is now in productive phase. Two face to face meetings (kick-off and progress#1) were organised as well as 5 skype meetings convened when necessary.

One major issue was the transfer of activity from DCE to NIVA (DK), a branch of NIVA (No). Since NIVA is already a partner, this was feasible without having to go into any administrative work with the Commission. This arrangement is based on the fact that the technical staff are also transferred from DCE to NIVA, which ensures that the expertise described in the DoW remains fully available to the project.

7. User Feedback

Provide a complete record of feedback received from user (formal and informal) on your portal, your activities or those of other EMODnet projects/activities. Also provide any suggestions you have received for EMODnet case studies and/or future products/activities/events.

Most feedback is through the indicators in section 9. However a few other users contacted

us specifically, who are reported below.

Date	Organization	Type of user feedback (*e.g. technical, case study etc)*	Response time to address user request
May 2014	EMODNET Chemistry and Biology partner	Need of the broad scale map for Marine Spatial Planning in the Adriatic and Ionian seas	End summer 2014 (V1)
Jul. 2014	French Office national de la mer et du littoral	Need of habitat statistics from the broad scale map for French MSFD marine regions	One month (Aug. 2014)

8. Outreach and communication activities

Please list all the relevant communications activities or products you have developed/executed during this period (including presentations, lectures, trainings, demonstrations and development of communication materials such as brochures, videos, etc.). Relevant scientific and/or popular articles you know have been published using/referring to EMODnet.

Date/Audience	Media	Title	Short description and/or link to the activity
Sept. 2014 (Online, see below	Printed brochure and online PDF	EUSeaMap: A broad-scale physical habitat map for European Seas	An attractive brochure to describe the achievements of EUSeaMap phase 1 and what to expect from phase 2 of the project. Hard copies are available.
Apr. 2014 (40 people)	Powerpoint presentation	ValorIG workshop in Nantes (Ifremer)	Presentation of the various EMODNet lots and the links between them
Mar. 2014	Powerpoint presentation	MyOcean2 project meeting Athens (JNCC)	Presentation of the data needs of EUSeaMap at a MyOcean 2 workshop.
May 2014 (12 people and online)	Powerpoint presentation and online PDF	ICES WGMHM San Sebastian (Ifremer)	Presentation of EUSeaMap2 (objectives and description of work packages), and specific section in the ICES WGMHM annual report.
May 2014	Oral presentation	Turkey-EU Maritime Dialogue 2nd meeting (METU)	Under agenda item "Involvement in seabed habitat mapping and marine data networking (EMODNET)" with a brief from DG-MARE representatives.

EUSeaMap brochure at http://www.emodnet-seabedhabitats.eu/default.aspx?page=2024

9. Updates on Progress Indicators

Indicator 1 -Volume of data made available through the portal

The main data products made available through the portal are listed below. The first two were created prior to the start of EUSeaMap 2 and the latter during year 1.

- EUSeaMap 1 and MeshAtlantic broad-scale habitat maps at a scale of 1:250,000 covering an area of around 2 million km^2 and 356,000 km^2, respectively.
- 273 habitat maps from surveys collated as part of the MESH and MeshAtlantic projects. These are at a range of scales and cover a total area of around 290,000 km^2. EUSeaMap 2 has not yet begun the process of collating habitat maps from surveys.
- The current broad-scale map delivery for Adriatic and Canary Islands which are uploaded to the central portal.

Indicator 2 -Organisations supplying each type of data based on (formal) sharing agreements and broken down into country and organisation type (e.g. government, industry, science).

EUSeaMap2 primarily uses data supplied by the other EMODnet lots. However in the past 12 months we have used a variety of datasets to create draft the broad-scale habitat maps for the Adriatic and Macaronesian waters and prepare future work. They are listed below:

- Unesco IBCM map (International bathymetric chart of the Mediterranean)
- Croatia: State Institute for Nature Protection (Dr. matija Frankovic): Croatian marine habitat data made available
- We received from RAC/SPA all the available data for the Montenegro (coming from the MedMPAnet Project), in particular the recent georeferenced maps of marine habitats of the Kotor Bay.
- With regard to Albania, we acquired the official data submitted by Albania to CBD, supporting a new EBSA for the Albanian waters and including *Posidonia* meadows.
- Slovenia: We had fruitful returns from the Institute of the Republic of Slovenia for Nature Conservation which sent us data of Posidonia meadows. These polygons, too small to be represented in the broad scale map, will be an input to thresholds statistics. We are expecting depth data to complement meadows data and also possibly other habitat data this institution may possess.
- As a sub-contractor Turkey provided the project with many data, namely:

- 3700 PAR (light penetration) profiles for the Black Sea
- Density data defining the periazoic (low oxygen at 15.2 isopycnic) and anoxic zones (16.2).
- Temperature, salinity and oxygen data for the Black Sea
- Posidonia data southern Aegean Sea

Indicator 3 - Organisations that have been approached to supply data with no result, including type of data sought and reason why it has not been supplied.

Mediterranean biocenoses data (posidonia, coralligeneous, rhodoliths) from the Mediseh project were not obtained to date in spite of our best efforts. Reasons for failure are unknown.

Indicator 4 -Volume of each type of data and of each data product downloaded from the portal

The table below summarises the data products downloaded from the EUSeaMap 1 and MESH portals which will soon be combined to form the EUSeaMap 2 portal. Summaries are provided for the bi-monthly and annual reporting periods (up to 5 Aug.)

Portal	**Layer**	**09/07/14 to 05/08/14**	**09/09/13 to 05/08/14**
EUSeaMap	Predicted habitats - North Sea and Celtic Sea	17	211
EUSeaMap	Predicted habitats - Baltic Sea	1	55
EUSeaMap	Predicted habitats - western Mediterranean Sea	5	103
EUSeaMap	Energy - North Sea and Celtic Sea	6	59
EUSeaMap	Energy/Wave Exposure - Baltic Sea	6	44
EUSeaMap	Seabed Substrata - western Mediterranean Sea	3	52
EUSeaMap	Halocline - Baltic Sea	1	22
EUSeaMap	Salinity - Baltic Sea	1	29
EUSeaMap	Fraction of light at the seabed - North Sea and Celtic Sea	3	47
MESH	EUNIS habitat maps from surveys	20	195

MESH	Confidence and study areas for EUNIS habitat maps	10	103
MESH	OSPAR threatened and/or declining habitats	3	161
MESH	Predicted broad-scale EUNIS habitats - Atlantic area (2013)	3	111
MESH	MESH EUNIS Model (2008)	0	0
MESH	National Marine Landscape Maps	2	105

Additionally, statistics from the French portal Sextant have been compiled. Sextant gives access to a 100m resolution of the broad-scale map for France only, which is an improvement of the European EUSeaMap produced in 2011 along the same methodological lines. These maps are in Sextant's top 5 for visualisation. Consultation of metadata has reached a total of 3377 since May 2013. Downloads are reported in this table:

Portal	**Layer**	**Since May 2013**
Sextant	Broad-scale habitats - France – 1:1M	103
Sextant	Broad-scale habitats – France – 1:300 000	106
Sextant	Biological zones – France - 1:300 000	28

Indicator 5 -Organisations that have downloaded each data type

The table below lists the organisations that have downloaded from the EUSeaMap 1 and MESH portals which have now been combined to form the EMODnet Seabed Habitats portal. Users are required to enter this information in an online form before they are allowed to download data. Lists are provided for the bi-monthly and annual reporting periods.

EUSeaMap 1 portal 09/09/13 to 05/08/14		**MESH portal 09/09/13 to 05/08/14**	
ABPmer	NIOZ	Aberystwyth University	Kent and Essex Inshore Fisheries and Conservation Authority
Aires Marines	NIVA	ABPmer	KTH Royal Institute of Technology
Alderney Commission for Renewable Energy	NLWKN-NY	ACRI-ST	Lancashire County Council
Alderney Wildlife Trust	Norwegian Institute for Water Research	AFBI	Lancaster University
AMEC	Oil Spill Response	Agence des aires marines prot├®g├®es	Local Authority
APEM Ltd	Pablo de Olavide, Seville (personal use)	Alderney Wildlife Trust	

ARCADIS	Plymouth university	Aquatera Ltd	Marine institute
Aristotle University of Thessaloniki	RAC-SPA	ARCADIS	Marine Management Organisation
Atkins Global	Ramboll (consultancy)	Archipelagos, Greece	Marine Mapping Ltd
Bioconsult	Repsol	Aristotle University of Thessaloniki	Marine Scotland
BMT Cordah	research	Autonomous University of Barcelona (UAB)	Marine Scotland Science
Bonn Agreement	SGI-SPA	AZTI-Tecnalia	MSFD Ireland
CCMAR	SIFT-UK	AZTI-Tecnlia	Napier university
cefas	SNH	Bangor University	Navionics
consultant	SSE	BIM	NBDC
Crown Estate	The Marine Biological Association of the United Kingdom	Bio3	NE
Developpement Durable	TheRedTentacle	Bio-Littoral	Newcastle University
devotes	UNEP-RAC/SPA	BMT Cordah	NUI Galway
DFPO	UNIMAR	Bonn Agreement	NUIM
DHI	Univeristy of Ulster	Bournemouth University	oceanDTM Limited
DMS	Université Bordeaux 1	BP	Oceansnell, S.L.
DMU	Université de La Rochelle, France	Cardiff University	Offshore Survey Company
DOENI	university assessmenU	CCMAR	OMV UK Limited
DTU Aqua	University College Cork	ccmar, university of algarve	OpenHydro
Edinburgh Napier University	University Of Aberdeen	CESAM/ UA	OSPAR
EEA - ETCSIA	University of Aveiro	Coastal Vision	personal use
Environment Systems	University of Bangor	Danish Fishermen	Plymouth University
Envision mapping ltd	University of Bournemouth	Danish Nature Agency	Portuguese Wildlife Society
ERM	University of Brest	DDTM	Queen's University Belfast
ETCSIA	University of Cardiff	Deltares	Ramboll
ETHZ	University of Exeter	Department of Arts, Heritage and the Gaeltacht	Ramboll UK
European Institute for Marine Studies "personal use"	University of Helsinki	Department of the Environment Northern Ireland (Marine Division)	Repsol
Finnish Environment Institute	University of Liverpool	Deutschland	RES Offshore
Footprint Ecology	University of Malaga	DFDF	RHDHV
Fugro EMU limited	University of Newcastle	DGRM	Royal Haskoning DHV
Galway	University of Oslo	DOE Marine Division	RPS
GIS Posidonie	university of Rome Tor Vergata	DONG Energy	RPS Consulting Engineers
Greece	University of Rostock	DOP	RPS Energy
Hartley Anderson	University of Southampton	EC Joint Research Center	RPSgroup
Heriot-Watt University	University of Swansea	Edinburgh Napier University	RSPB
IAMC	University of the Highlands and Islands	enea	Ryan institute, NUIG
IECS	University of Ultser		Saint Andrews
IFREMER	University of York		Scottish Association for Marine Science
IHC Merwede			Scottish Environment LINK

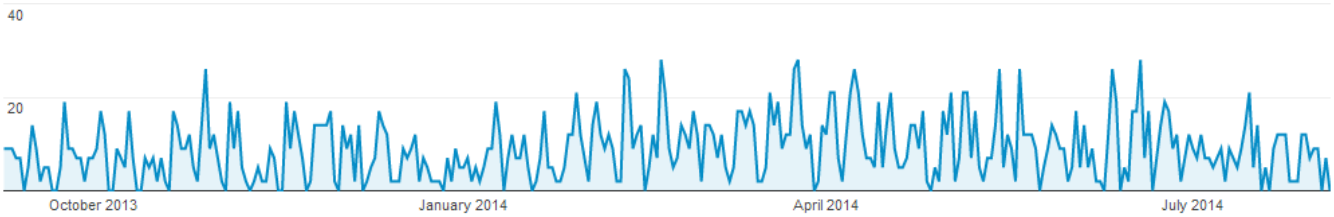
ILVO IRELAND IUCN Joint Research Centre JRC-IES Kent and Essex IFCA LÃ¤nsstyrelsen VÃ¤sternorrland Marlab Masters dissertation, University of Bangor MCS UK Ministry of Infrastructure and Development Natural Power Navionics Newcastle University	Uudenmaan liitto, Helsinki-Uusimaa region VLIZ WSP Group WSP Sweden AB WUR Xodus Group	Environment Agency Envision Mapping Ltd ERM Esri UK Flintshire geoscience Food certification international French Marine Protected Areas Agency FROM Nord Fugro EMU limited Fugro OSAE Galway Galway Mayo Institute of Technology Gardline Ghent University GoBe Consultants Ltd Hafok AB Heriot-Watt University ICES Ifremer IMAR IMSA Amsterdam Inland Fisheries Ireland IEO Intertek EWCS IPMA - Portuguese Institute for the Ocean and Atmosphere IRELAND IUCN Joint Nature Conservation Committee Joint Research Centre Van Hal Larenstein XodusGroup York university	Scottish Natural Heritage Scripps Institute of Oceanography Seastar Survey Ltd. SIFT Soft Air Solutions SSE States of Guernsey Student in UGent Suffolk Swansea university The Marine Biological Association of the United Kingdom TheRedTentacle Thomson Ecology UBO UNEP World Conservation Monitoring Centre, Cambridge Univeristy of the Highlands and Islands Universidade do Minho Université de La Rochelle University College Cork University College Dublin University of Aberdeen University of Aveiro University of Azores University of Exeter University of Glasgow University of Greenwich University of Hull University of Miami University of Southampton University of St Andrews University of Strathclyde University of Ulster

Indicator 6 -Using user statistics to determine the main

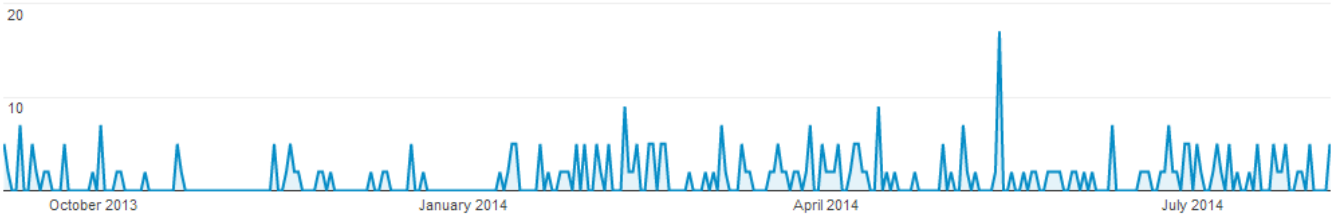
pages utilised and to identify preferred user navigations routes

User statistics for mapper and download pages of EUSeaMap 1 and MESH portals. Statistics are given for the bi-monthly and annual reporting period. *Due to an error, MESH annual statistics are only for the period 24/02/14 to 04/08/14.

page description	page address	Number of unique visitors		How many users end their visit on this page		Average residence time (mm:ss)	
		09/07/14 to 05/08/14	09/09/13 to 05/08/14	09/07/14 to 05/08/14	09/09/13 to 05/08/14	09/07/14 to 05/08/14	09/09/13 to 05/08/14
EUSeaMap 1 mapper	jncc.defra.gov.uk/page-5040	188	2,236	141	2,238	02:23	03:15
EUSeaMap 1 downloads	jncc.defra.gov.uk/page-6266	35	372	10	116	01:35	01:30
MESH mapper	www.searchMESH.net/mapper	83	587*	67	562*	02:57	03:01
MESH downloads	www.searchMESH.net/downloads	24	478	21	563	01:24	02:25



Visitors to the EUSeaMap 1 mapper page from 09/09/13 to 05/08/14.



Visitors to the EUSeaMap 1 download page from 09/09/13 to 05/08/14.

Indicator 7 -List of what the downloaded data has been used for (divided into categories e.g. Government planning, pollution assessment and (commercial) environmental

assessment, etc.)

This information is now collected from the form that users fill out when downloading data from the portal's download page (see http://www.emodnet-seabedhabitats.eu/access-data/download-data/). A pre-defined list of categories was agreed with the EMODnet Secretariat in summer 2014 and has also been introduced. During the reporting period, however, this information was collected through a free-text field on the MESH portal download page. The same information was not previously collected by the EUSeaMap portal; although, in some cases it could be assumed from the type of organisation (see indicator 5).

Reasons for downloading data from MESH portal – 09/07/14 to 05/08/14.

Creating marine habitat maps for a 'internal' research project for the UK Royal Society of Wildlife Trusts. Fisheries Habitat Mapping Mapping marine communities of Canary Islands Interreg project	Mapping survey results of the distribution of an invasive sea-squirt Didemnum vexillum in Clew Bay, Co. Mayo, Ireland. master thesis scientific research student work To produce overlay with fishing effort map.

Reasons for downloading data from MESH portal – 09/09/13 to 05/08/14.

Academic research Analysis for optimal location of aquaculture sites analysis in Scotland Analysis of environmental sensitivities offshore north sea. Application for the 28th Licence Round - Environmental impact assessment part for DECC Alice Gadney - Cartographer -OMV UK 02073331985 Assessment of an invertebrate fishery and supporting ecosystem in the West coast of Ireland Assessment of MPA network and Marine Habitat Mapping Assist with research survey design and to contribute to	Habitat analysis Habitat assessments in Polessie protected areas/IBAs Habitat Mapping Habitat Modelling - PhD Research Habitats Directive assessment compilation of data on the marine environment I am a PhD student looking into over-wintering wading birds on estuaries and being able to see some biotopes for the mudflat they forage upon would be very useful. I am currently working on species distribution modelling and I need a lot of spatial data to perform my task. I am a PhD	Research ecological status surrounding oil platforms. Research for job application. Research into climatic change effects on marine habitats and species Research into marine spatial planning Research into Nature Value and Nature Valuation Research project Research purpose Scientific purposes Scientific research Scientific use to model cetacean and seabird distributions along Portuguese mainland coast

ICES/OSPAR assessment Atlantic Sea in Azores Investigation background research for offshore route Bay of Biscay marine habitat mapping and management Bonn Agreement BE-AWARE project Building GIS map of habitats in Severn estuary Cable feasibility study Case study cartography to create a MPAs layout. Characterization of an area. Scientific research of the habitats in northern Spain Combining with VME Comparison with SNH survey deliverables to resolve apparent discrepancies Compilation of marine datasets for a strategic Environmental Assessment Creating marine habitat maps for a 'internal' research project for the UK Royal Society of Wildlife Trusts. Data Analysis Desk based feasibility study Desk based survey for Natural England ecosystem service assesmsent severn esyarry and bristol channel Ecosystem Service Mapping ecosystem service mapping severn estuary Educational use Environmental assessment Environmental Constraint Mapping Environmental Consultancy	student at IUEM-UBO, Brest, France I am doing a GIS project on wind farm location to puffin populations I am doing a proposed research project looking at spatial displacement of cetaceans for an MSc course. I am mapping marine communities of Canary Islands I wish to download these data to create and manipulate maps for awareness-raising and advocacy for the Scottish MPA network and the National Marine Plan. ICES working group Inform benthic habitat assessment of tidal project in Northern Ireland Interreg Valmer. North Devon case study Kent and Essex IFCA habitat survey Knowledge of possible impacts of trawling in the area. Learn about the ecosystems that surround drilling platforms through spatial analysis. LIFE+ Project on MPA in Portugal local old version corrupted MAIA project Mapping in PO Mapping of marine ecosystem services Mapping survey results of the distribution of an invasive sea-squirt Didemnum vexillum in Clew Bay, Co. Mayo, Ireland. Marine assessment Marine Mapping Project Marine protected area proposal	See possible impacts of trawl fishing in the area Sensitivity map for oil spill response planning Severn Estuary Mapping project Shoreline sensitivity mapping Statistical analysis study see beds in Azores STUDY-WORK Subsea cable feasibility study To assist authority to comply with the Biodiversity Duty and other regulations and guidance on environmental protection. To assist compliance with Biodiversity Duty To be able to describe the dataset as part of a marine data gap analysis for the EC funded EU BON project. to check habitat locations To check overlap to check overlap of habitats and activities To check overlap with habitats To compare my data with sediment characterization to compare with other habitat assessments in the same area To evaluate whether it can inform assessments of risk to marine ecosystems To incorporate data in habitat suitability modelling. To produce overlay with fishing effort map. To review content To update our records for NI

Environmental Desktop Study Environmental Mapping Environmental studies - EIA, ES etc. Establishing where Eunis habitats are in West of Shetlands Evaluation environnementale document de planification activit├®s en mer Figure creation for Department of Environment Northern Ireland by ABPmer. fisheries For a sensitivity mapping project within the NE of Scotland For connectivity assessment of macroalgae For environmental information on or near project sites and subsea cable routes. For inclusion in an EIA For potential usage in European project Turnkey (Atlantic Areas project) For reference in environmental planning. for scientific research of the Western Iberian margin For the web MPA OSPAR (GIS tool) For use in an ES For use in GIS projects along with our own fisheries and scientific data. For use in subsea cable scoping study. For use on a sensitivity mapping project along the NE coast of Scotland For use within GIS for offshore windfarm EIA work Gaining insight in spatial distribution of marine habitat	and for sampling preparation and planning for PhD. MIS RAZONES Model of effects fishing in the Celtic Sea Model of the effects of fishing on several species in the Celtic Sea Modelling MPA OSPAR study MPA OSPAR website MSc assignment MSFD analysis MSFD use. My PhD aims to model the habitat preference and spatial usage of seals' colonies. For this modelling work, I need environmental variables as sediment and seabed habitat. Needed to create maps for Celtic Sea Trout Project. The project is part funded by the European Regional Development Fund through the Ireland Wales Programme (INTERREG 4A). Offshore renewable SEA Offshore wind farm planning and EIA OSPAR habitat mapping program OSPAR use PhD examining vulnerability of Modiolus habitats across OSPAR areas PhD project is investigating climate change impacts to Modiolus beds PhD research PhD Study: using mapping to scope best areas to protect Irish Sea ray species. Preparing a tender response	Marine Conservation Zone designation process To update our records for the Northern Irelands Marine Conservation Designation Process. To use the data in future research To view results of habitat surveys carried out in Northern Irelands inshore and offshore waters. UK fisheries and environmental management Understanding the marine habitats around Guernsey Use in a postgraduate project Use in Ospar Cobam work Use in report for First Flight Wind use in research work and informative using data to examine vulnerability of Modiolus habitats Valmer Interreg We are computing a broad ecosystem map for the sea regions of Europe following EUNIS habitats classification at level 2. We are currently doing research on ecosystem services delivered by the Belgium North Sea. To calculate biodiversity values we need to have habitat data for specific species and there sensitivity. We are currently planning to conduct a coral habitat mapping in the eastern Mediterranean and want to compare our future data with

types. General interest General planning benthic survey. geoscience research regarding sound propagation through sediments GIS work about Marine Protected Areas Greater understanding for Environment Agency to use in WFD fish classification analysis for estuaries	and demo for OSPAR Project Consulting Project for a GIS class at Scripps Institute of Oceanography. Project for Northern Ireland Marine Task Force project on the impact of off shore windfarm on the biodiversity Quality check Reference Research	these data. We are recompiling GIS information related to the Azores Islands (Portugal) for scientific use. Work on the problem of coastal erosion Working on a project on support structure of offshore wind turbines Working on a project related to the impact of windfarm on the biodiversity Working on Euseamap 2 Working on strategic plan for aquaculture in Ireland

Indicator 11 – Publications

Date	Title	Short description and/or link to the activity
Submitted Jun. 2014 Ifremer	Broad-scale mapping of seafloor habitats in the north-east Atlantic using existing environmental data	This publication describing the making of a EUNIS broad-scale map was written in the frame of the EU Interreg MeshAtlantic project, however its foundations are those of EUSeaMap, which were further extended to the Atlantic Area.
Accepted Jun. 2014 AZTi-Tecnalia	Mapping ecosystem services provided by broad-scale benthic habitats in the European North Atlantic Ocean	This publication was written in the frame of the EU Interreg MeshAtlantic project, however its foundations are those of EUSeaMap which were further extended to the Atlantic Area. The paper attempts at a valuation of a number of predominant habitats according to criteria earlier developed in the FP7 Mesma project.
Presented in Sep. 2013	Assessing the Atlantic Area MPA network representativeness using the new MeshAtlantic broad-scale seafloor map	This presentation was given at the MeshAtlantic final conference in Aveiro on 17 Sept. 2013, however it is based on the broad-scale map made for the Atlantic Area to a large extent inspired from the EUSeaMap project.